Hadronic Validation and Testing

(Parallel Session VII; October 20, 2009)

Talks Presented

❑ Testing & Improvement of Inelastic Cross Sections

❑ Hadronic Generator Tests for Spallation & Low Energies

❑ Validation Effort at FNAL

❑ Geant4 Hadronic Validation Framework

❑ Discussion on New Validation Suites (if any)

14th Geant4 Workshop, Catania
October 22, 2009

Presentation 1 (M. Kosov)

Testing and Improvement of Inelastic π-A, K-A,

 pbar-A Cross Sections:

❑ The inelastic cross sections improved for cross section with π±, K± and pbar induced interactions.

❑ Hyperon-nuclear reactions are still to be covered.

❑ Improvement is seen in π±A cross section w.r.t. Barashenkov cross section for deuterium target

❑ Clear improvement w.r.t. Gheisha cross section for K±A and pbar-A inelastic interactions

❑ The updated inelastic cross section is almost ready

❑ Code will be available for usage of other hadronic models in Geant4.

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Presentation 2 (V. Ivantchenko)

Hadronic generator tests for spallation & low energies:

- ❑ Test30 is used routinely for testing low energy data (up to 3 GeV) with p/n beams on nuclear targets – also used in the IAEA spallation benchmark.

- ❑ Test35 has been developed and used to validate against HARP data – recent addition is the use of forward data.

- ❑ IAEA spallation benchmark includes double differential distribution for pions, nucleons, light charged ions and isotope production cross sections with n/p beam on a number of nuclear targets between 20 MeV and 3 GeV

- ❑ The tests indicate some problems in the generators

⟶ Nevertheless Geant4 hadronic models (Bertini and Binary) give competitive results in this benchmark evaluation.

Presentation 3 (S. Banerjee)

Validation effort at Fermilab:

❑ We now have a validation package of hadronic models in the form of test47 for the intermediate energy region.

– Inclusive proton/neutron productions in $\pi^\pm$/p induced interactions between 1.4-7.5 GeV/c beam momenta are best explained by Bertini and QGS-Bin model

– p-A data at 14.6 GeV/c are best explained by FTF-bin model

❑ The basic infrastructure for stopping particles is provided in test48 with the application software, ASCII data files, analysis Root macro and a minimal README.

– Stopping code for CHIPS is the best at the moment but still cannot explain π^- data for light nuclei

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Presentation 4 (J. Yarba)

Geant4 Hadronic Validation Framework:

❑ Requirement document is discussed within the G4 hadronic group and approved. It is serving as a guidance:
http://home.fnal.gov/~yarba_j/G4-HAD-Validation-Papers/G4VRequirements.doc

❑ System design is outlined which include:

– Resources to be used

– Workflow and applications

– Technology choices proposed (need Grid for some of the tests)

– Small-scale prototype building based on test47

❑ Design proposal will be finalized shortly, and presented to the group for review. Draft version exists:
http://home.fnal.gov/~yarba_j/G4-HAD-Validation-Papers/g4val_exec.pdf

❑ Developer aspects were discussed. Developer requirements are included in the requirement document and this will be included in the design document.

Discussion (D. Wright)

Scope of new validation suites:

❑ Need consolidation of stopping muon validation (already a test exists)

❑ Validation of low energy LEpn and LEpp models

❑ Several validation works are missing mainly because lack of data – in flight validation to be done for kaon, anti-proton, hyperon induced interactions.

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